

REMARKS

In view of the above amendments and following remarks, reconsideration of the rejections contained in the Office Action of May 31, 2005 is respectfully requested.

In the Office Action, the Examiner rejected claims 7 and 10-13 as unpatentable over Opsal, U.S. Patent 5,074,669 (Opsal) in view of Hiraga et al., WO 99/08149 (Hiraga) and Power, U.S. Patent 5,365,065 (Power) or Prekel et al., U.S. Patent 5,760,400 (Prekel). However, it is respectfully submitted that the present invention clearly patentably distinguishes over Opsal, Hiraga, Power and Prekel, particularly as now reflected in claims 14-17 above.

It is noted that independent claim 14 corresponds substantially with prior independent claim 7. The following points should be noted, however.

The present invention includes a beam expander 3 that receives the excitation light output from the excitation light source 1 after being modulated by the chopper 2. The beam expander enables collimation adjustment in a direction of a light path of the excitation light and a biaxial centering in a direction perpendicular to the excitation light path. It is positioned so as to emit the excitation light as non-parallel light ray beams when the excitation light is emitted from the excitation light source. Note the discussion beginning at the middle of page 7 of the original specification.

As is further indicated therein, the beam expander 3 enables collimation adjustment in the directions A. The beam expander 3 further enables bi-axial centering in the direction of B. Note Fig. 2, for example.

The probe light that has been output from the probe light source 4 is emitted as parallel light-ray beams from a collimator lens 5. They are composed in the same axis together with the excitation light by means of a dichroic mirror 6. The excitation light and the probe light differ in wavelength from each other.

It should be noted that it is impossible to execute an analysis for an ultra-fine-particle by using a thermal lens microscope in principle when both the excitation light and the probe light focus at the same point on an optical axis within a specimen. It does become possible to execute the analysis for the ultra-fine-particle by detecting a degree of diffusion of the detection light in the thermal lens

produced by the excitation light only when the detection light focuses at a point before or after the focal point of the excitation light.

Because the precision of the optical system of the conventional analysis using the thermal lens effect was insufficient, the difference of focal points has been obtained due to the chromatic aberration by using two light sources which emit light beams having different wavelengths. However, there is very little chromatic aberration in the high-precision desktop thermal microscope apparatus according to the present invention, and the probe light that passes through the collimator lens 5 comprises parallel light-ray beams. Accordingly, if the excitation light that passes through the beam expander 3 is not non-parallel light ray beams, the relationship between the focal points as described above could not be realized.

It should be noted that independent claim 14, as prior claim 7, recites a beam expander, and not just a collimating lens. The beam expander 3 of Fig. 2 comprises two optical components. One optical component is movable in the direction indicated as arrow A, and the other optical component is movable in the direction indicated by arrow B. Thus it is clear that the beam expander that is claimed is not simply a collimating lens. Further, one of ordinary skill in the art understands that the beam expander 3 adjusts the excitation light so that light ray-beams have a different parallelity from that of the detection light, i.e. non-parallel light-ray beams.

Opsal does not disclose or suggest "a beam expander that enables collimation adjustment in a direction of a light path of the excitation light and biaxial centering in a direction perpendicular to the excitation light path and which is positioned to emit the excitation light as non-parallel light-ray beams when the excitation light is emitted from said excitation light source." The beam expander referenced by the Examiner in Opsal has reference number 26. Column 4 of Opsal describes that "intensity modulated beam 22 is then passed through a beam expander 26 and an isolator 28 . . ." This is the entirety of the structural and operational description of the beam expander 26 of Opsal. Thus, it appears that the beam expander 26 of Opsal merely has the function of changing the optical diameter of the excitation light pump beam, with the pump beam that has passed through the beam expander 26 becoming a parallel light-ray beam.

It should also be noted that Opsal only refers to the thermal effect in the explanation of the second term of Equation 2 in column 6. Opsal clearly distinguishes the thermal effect from the effect of modulating the layer thickness either through thermal or plasma wave-induced expansion which is the object to be detected. Opsal clearly does not disclose or suggest the claimed high precision desktop thermal lens microscope apparatus.

The present inventors have realized, for the first time, an ultra-fine-particle analyzing microscope that is portable and has excellent spatial resolving power and quantitative-analysis capability by using the optical system including the beam expander 3 and by integrating the analyzing mechanisms utilizing thermal lens effect into a single housing. High spatial resolving power cannot be obtained by using the conventional optical system having chromatic aberration. In the case where a general purpose group of lenses that is equivalent to the beam expander 3 is provided by trial and error in a laboratory, as in Morris et al., U.S. Patent 4,591,272, analyzing mechanisms utilizing the thermal lens effect cannot be integrated into a single housing, and portability could not be expected in such instance.

Hiraga discloses an optical system comprising two laser sources 1, 2, a condenser lens 7, an ND filter 3 and a shutter 4. Excitation light and a probe light are focused at the same position in an optical element 8 as shown in Figs. 1, 3 and 4.

Power discloses two beam expanders 6 and 13. However, Power merely discloses a configuration for applying parallel light-ray beams focused at infinity, as shown in Fig. 1 and column 9, lines 16-17 of the patent.

Prekel discloses a chopper 28, but does not include a beam expander. Prekel merely discloses an optical system "such that the position of intersection of said visible locating beam and the desired measuring point coincide on the work-piece coating surface," as illustrated in Fig. 1 and by claim 1 of the patent.

Morris discloses a lock-in amplifier signal processing and PLL control in a photothermal deflection detector.

Thus, it is clear that none of the additionally-cited references cure the deficiency of Opsal.

It is noted that all of the aspects for which the various references were cited have not been specifically addressed above. This is in view of the clear distinction over the references. Applicants reserve their rights to specifically address any and all positions made by the Examiner in the Office Action of May 31, 2005 at such time as may become necessary.

In view of the above amendments and remarks, it is submitted that the present application is now in condition for allowance, and the Examiner is requested to pass the case to issue. If the Examiner should have any comments or suggestions to help speed the prosecution of this application, the Examiner is requested to contact Applicants' undersigned representative.

Respectfully submitted,

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October 31, 2005